U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

Ryerson University

ELEVATE

RYERSON UNIVERSITY

Team Elevate

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Office Building Division | TRCA Satellite Visitors Centre and Office

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Comfort and Environmental Quality
Occupant Experience
Integrated Performance
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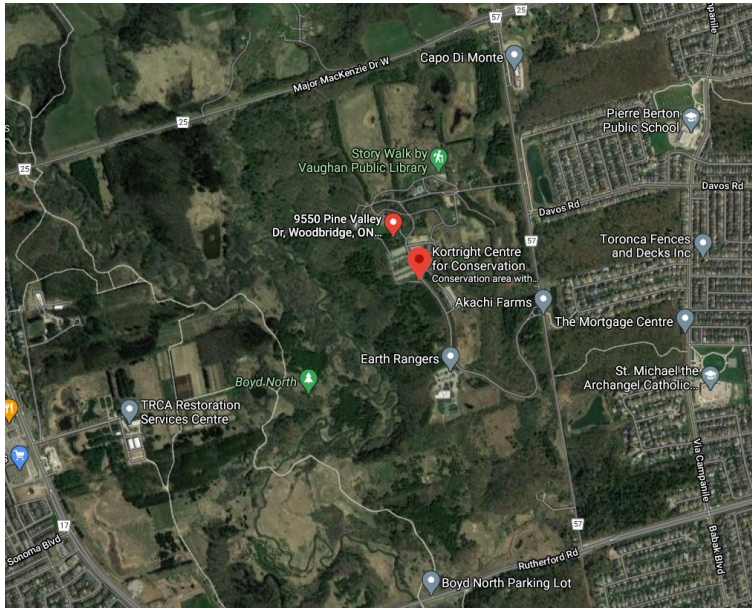
Conclusion

SITE & LOCATION



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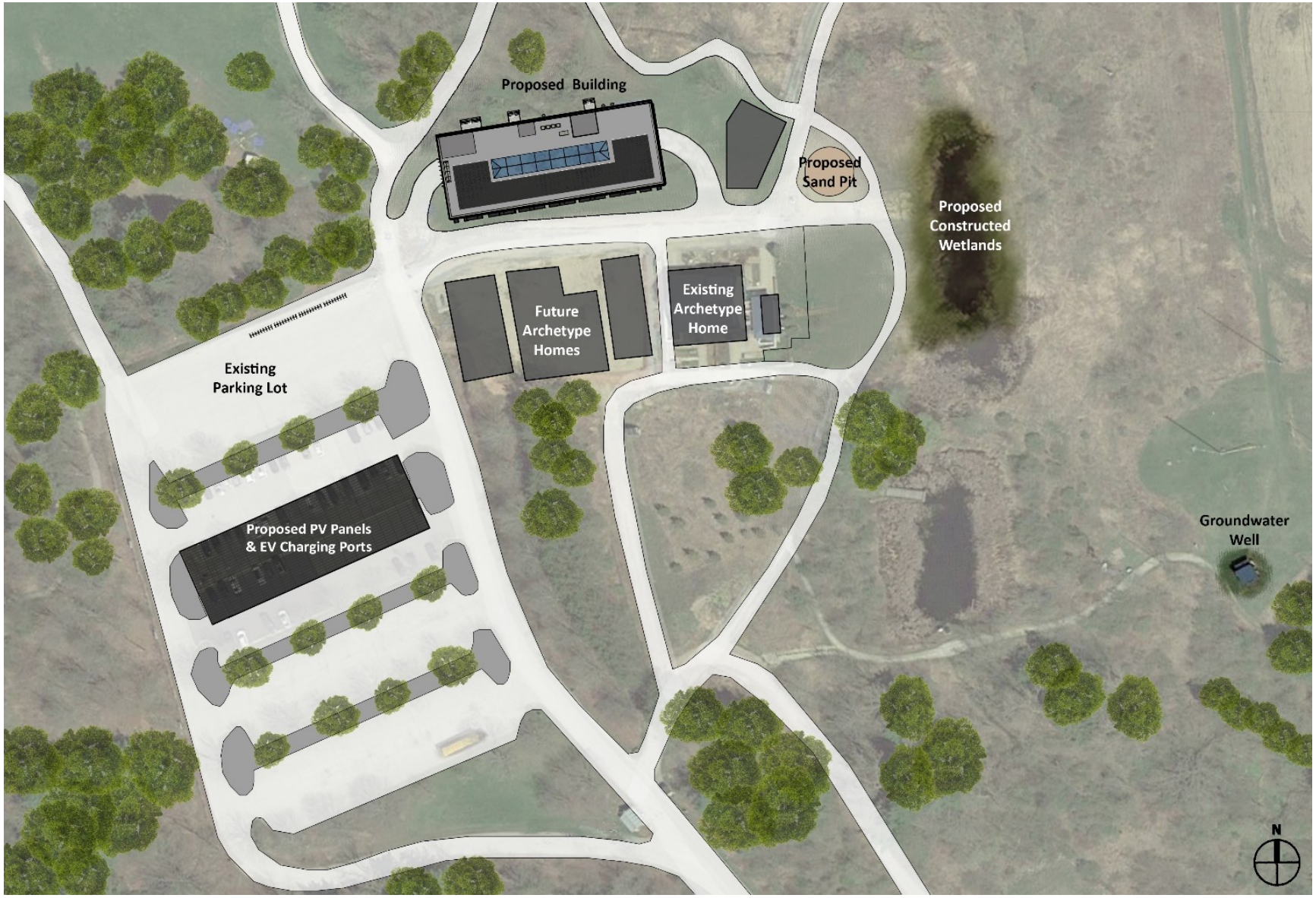
Site Plan

Site area : 325 hectares
Building Area: 41,660ft^2 (3,870 m^2)



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Our Vision

Present

Proposed

Future

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Design Goals Set & Achieved

Net-0 Operational & Lifetime Carbon

Net-0 Energy

Net-0 Water

Disassembly & Reassembly

Occupant Health & Wellbeing

Educate

Circular Economy

Minimal Impact on land & Positive Community Contribution

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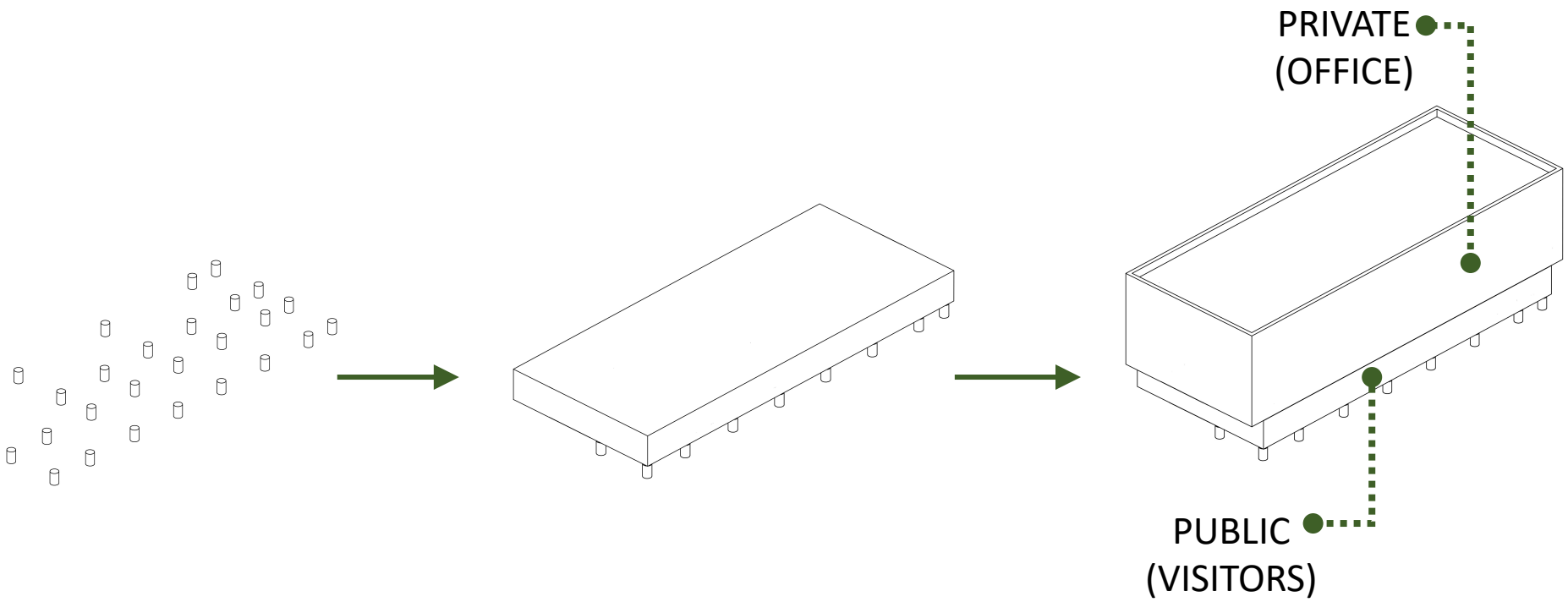
BUILDING FORM SEQUENCE



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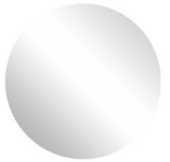
Exterior Design

West Façade
WWR: 28%

East Façade
WWR: 29%

WEST ELEVATION

Vertical Wood Siding



Transparent Glass

Mirrored Exterior Finish

South Façade
WWR: 33%

North Façade
WWR: 7%

SOUTH ELEVATION

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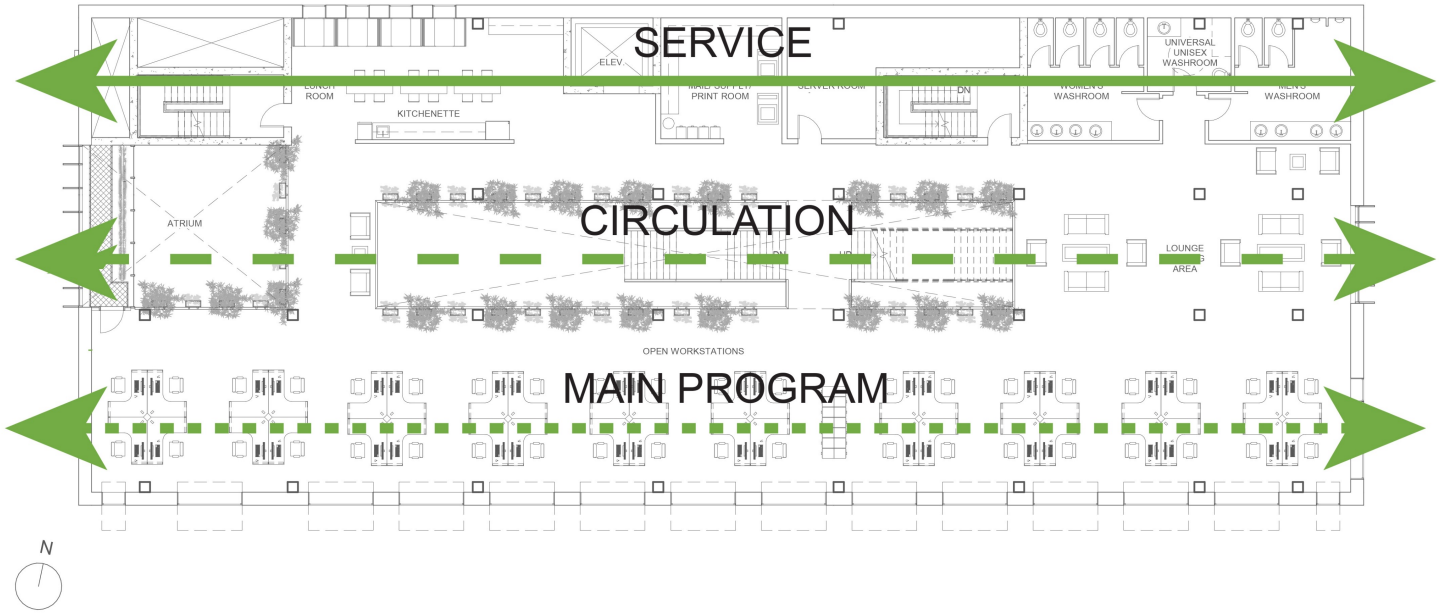
BUILDING PROGRAM PRINCIPLE



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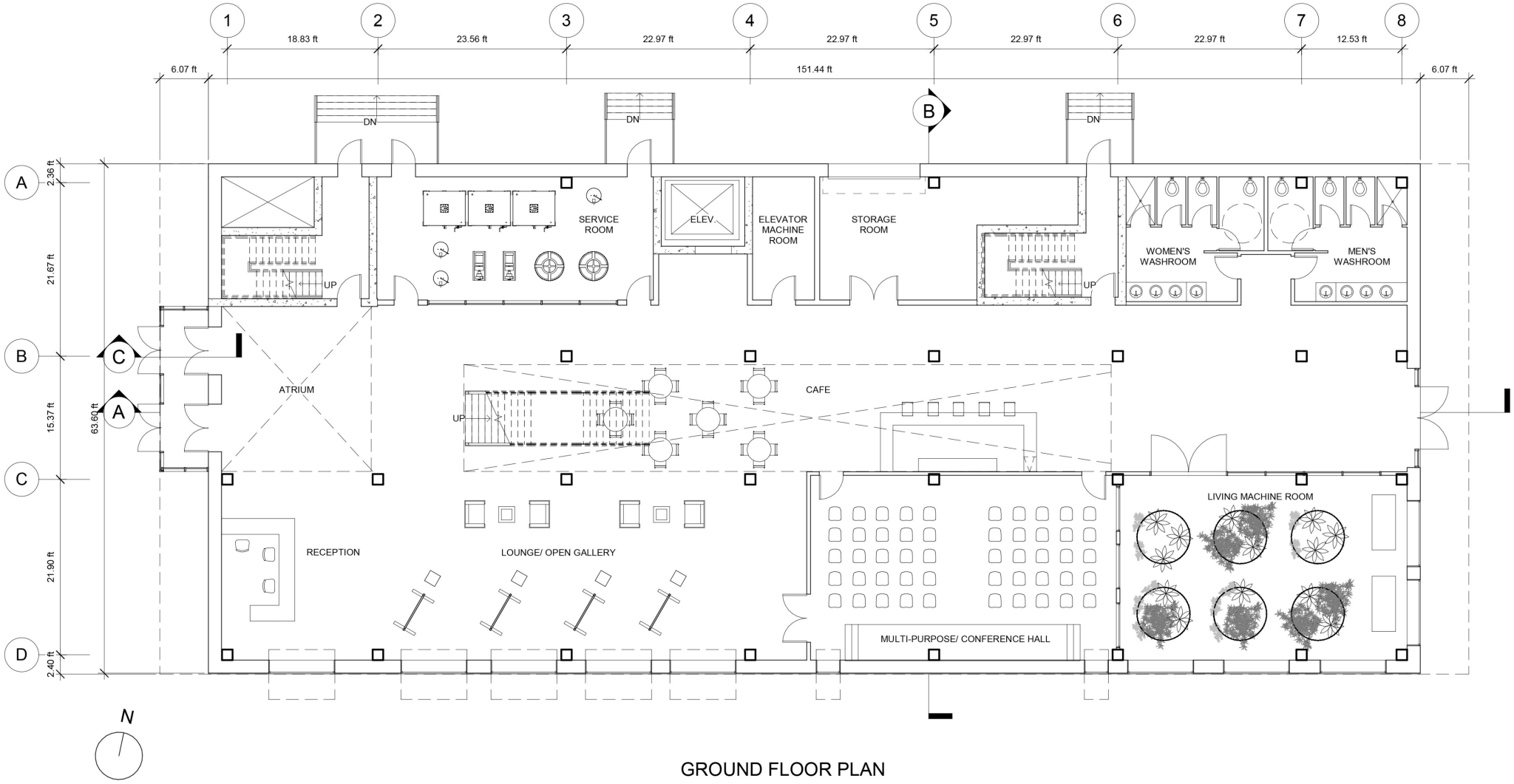
FLOOR PLANS



GROUND FLOOR PLAN

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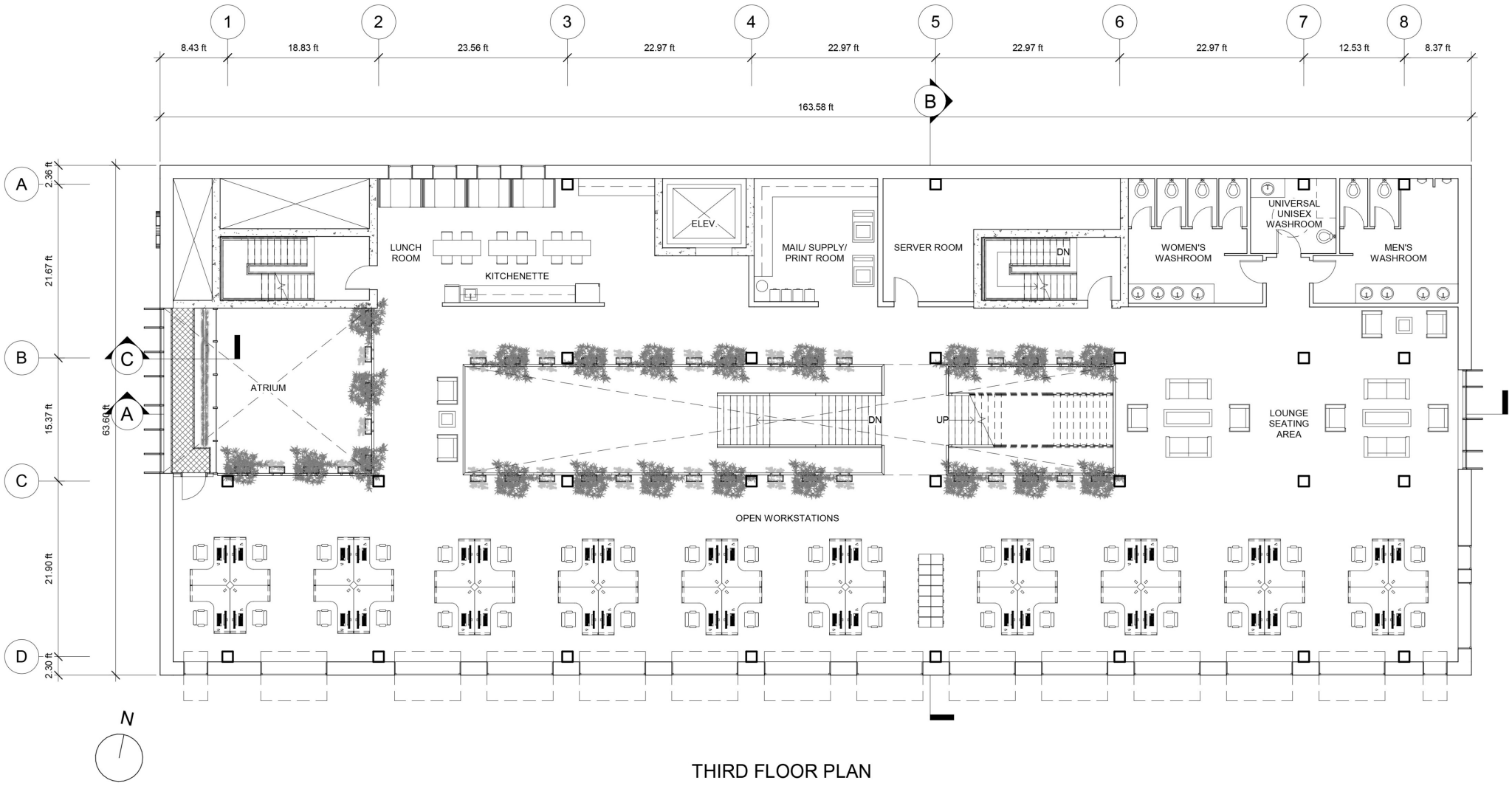
FLOOR PLANS



THIRD FLOOR PLAN

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INTERIOR RENDERS

Ground floor service room and main staircase

View from second floor main staircase

Ground floor multi-purpose conference hall

View of green wall from second floor

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Interior Renders

View of second floor private offices

View of third floor open workstations

View from fourth floor open workstations

View from top of fourth floor main staircase

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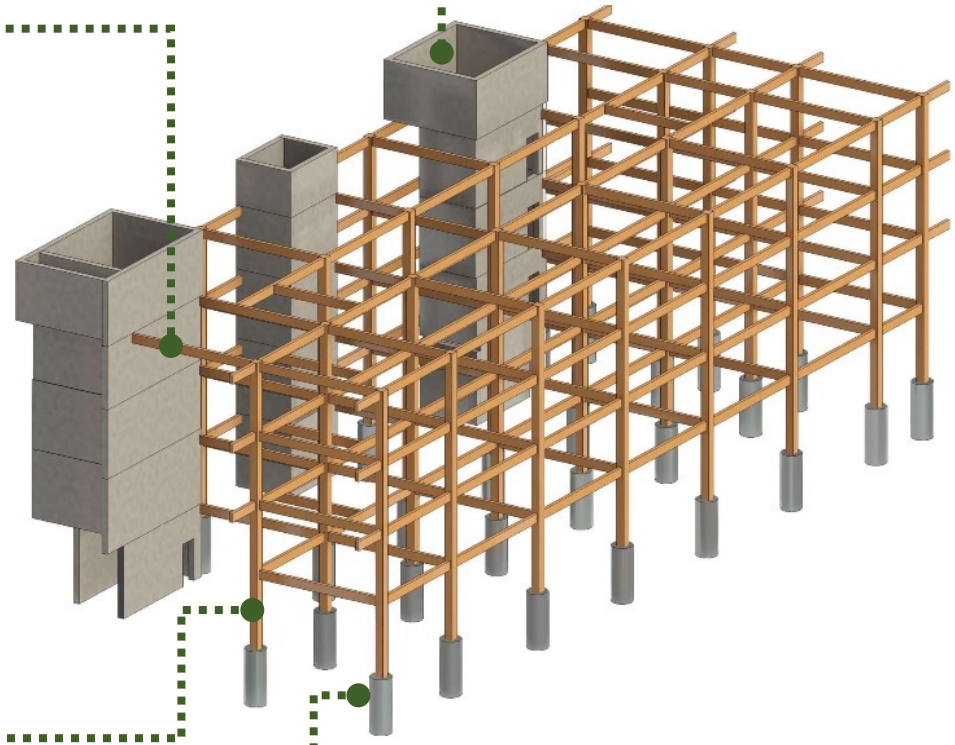
STRUCTURE

Concrete Precast
Panel cores

Glue-Laminated
Timber (GLT) Beams



Glue-Laminated
Timber (GLT) Columns

Timber Concrete
Composite (TCC) floors

Concrete Piles

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PANELIZED MODULAR ENVELOPE CONSTRUCTION

SOUTH ELEVATION

EAST ELEVATION

NORTH ELEVATION

WEST ELEVATION

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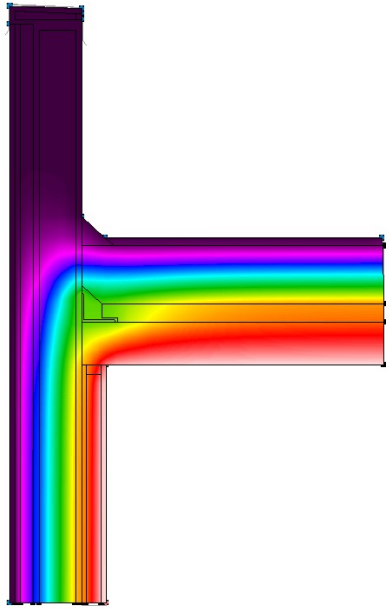
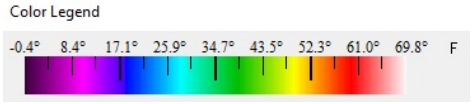
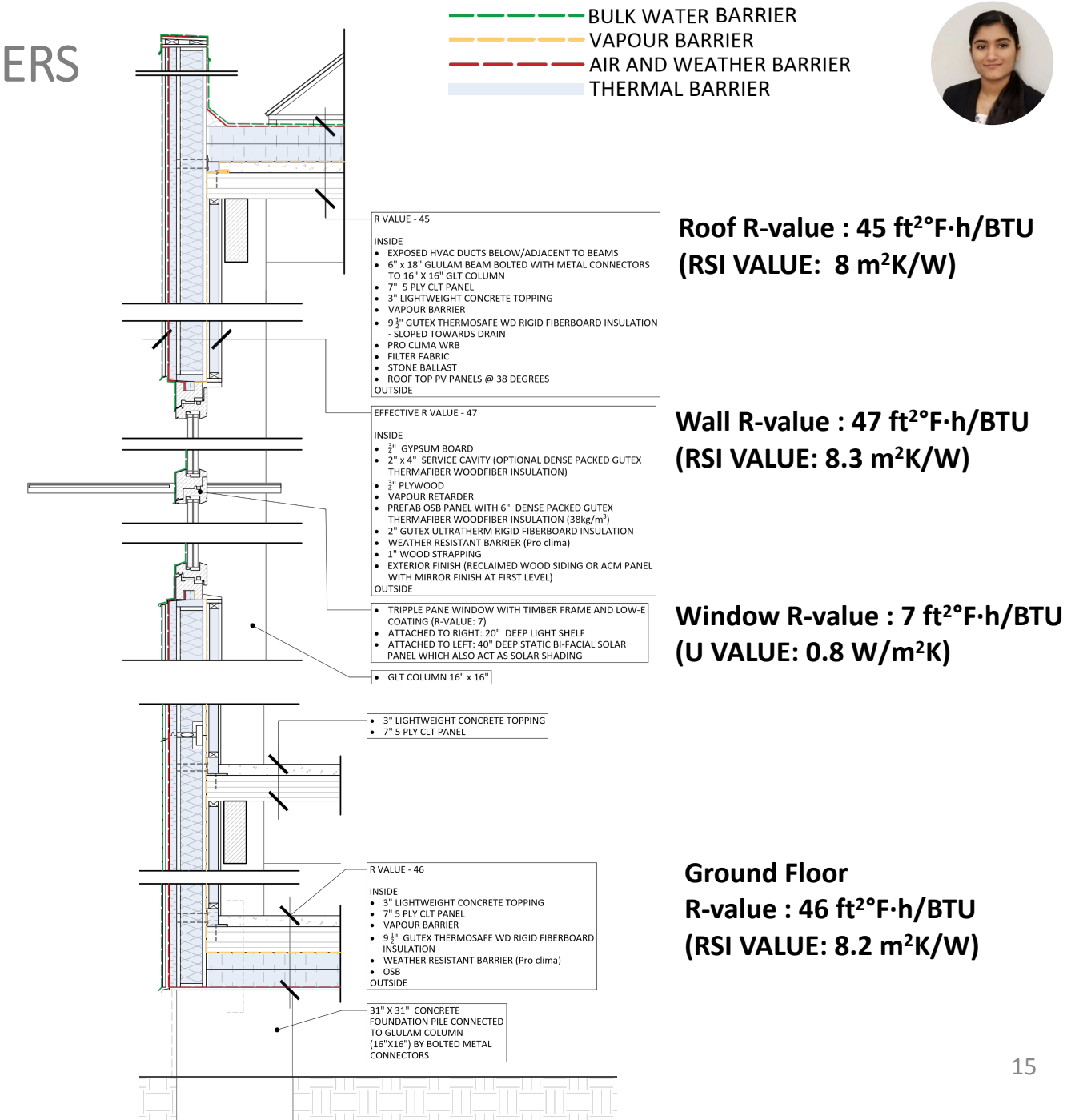
ENVELOPE CONTROL LAYERS







Roof R-value : 45 ft²°F·h/BTU
(RSI VALUE: 8 m²K/W)

Wall R-value : 47 ft²°F·h/BTU
(RSI VALUE: 8.3 m²K/W)

Window R-value : 7 ft²°F·h/BTU
(U VALUE: 0.8 W/m²K)

Ground Floor
R-value : 46 ft²°F·h/BTU
(RSI VALUE: 8.2 m²K/W)

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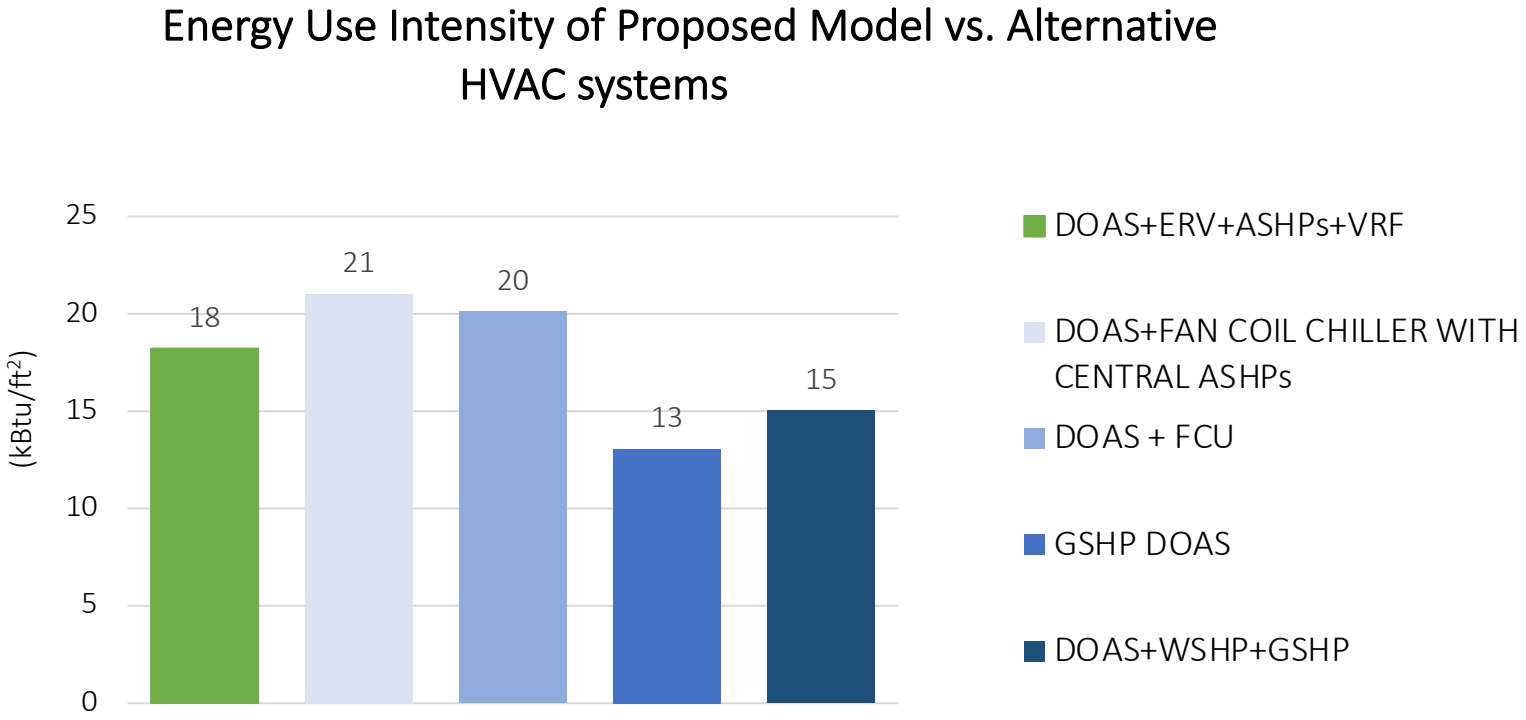
HVAC Systems Simulated Through Open Studio



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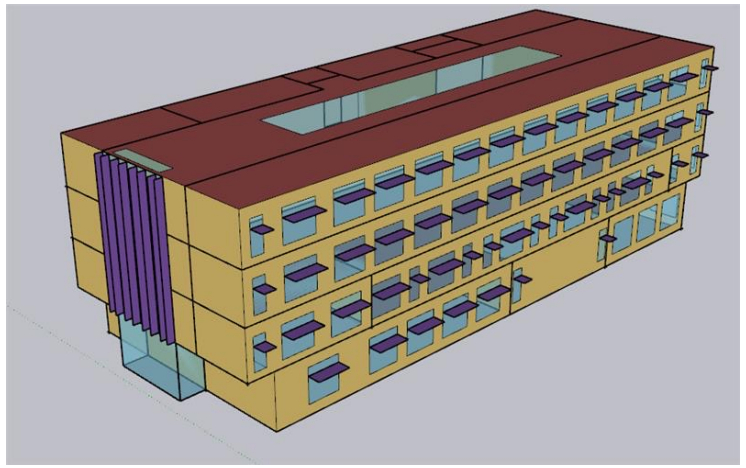
BUILDING ENERGY SIMULATION



A baseline represents a typical modern building. (EUI before renewables).

Target EUI is 20 based on a 82% reduction

	Proposed Designed (Before Renewables)		Solar Decathlon Requirement	Toronto Green Standard (TGS) Tier 4 Requirements
	Conversion Factor 1	**Conversion Factor 1.96**		
Source EUI	20 kBtu/ft^2 (62 kWh/m^2)	39 kBtu/ft^2 (123 kWh/m^2)	96 kBtu/ft^2 (303 kWh/m^2)	—
Site EUI	20 kBtu/ft^2 (62 kWh/m^2)		—	20.4 kBtu/ft^2 (65 kWh/m^2)
TEDI	4.4 kBtu/ft^2 (14 kWh/m^2)		—	4.7 kBtu/ft^2 (15 kWh/m^2)
GHGI	0.5 lbCO_2e/ft^2 (2.2 kgCO_2/m^2)		—	0.91 lbCO_2e/ft^2 (4 kgCO_2/m^2)

BUILDING SUMMARY

LOCATION	Vaughan, ON	L4L 1A6
USES	Office	33,282 sq.ft (100.0%)

RESULTS	BASELINE	YOUR BUILDING
EUI % Reduction from Baseline	0%	82%
Zero Score	100	19
Site EUI (kBtu/ft²/yr)	107	20
Source EUI (kBtu/ft²/yr)	167	31

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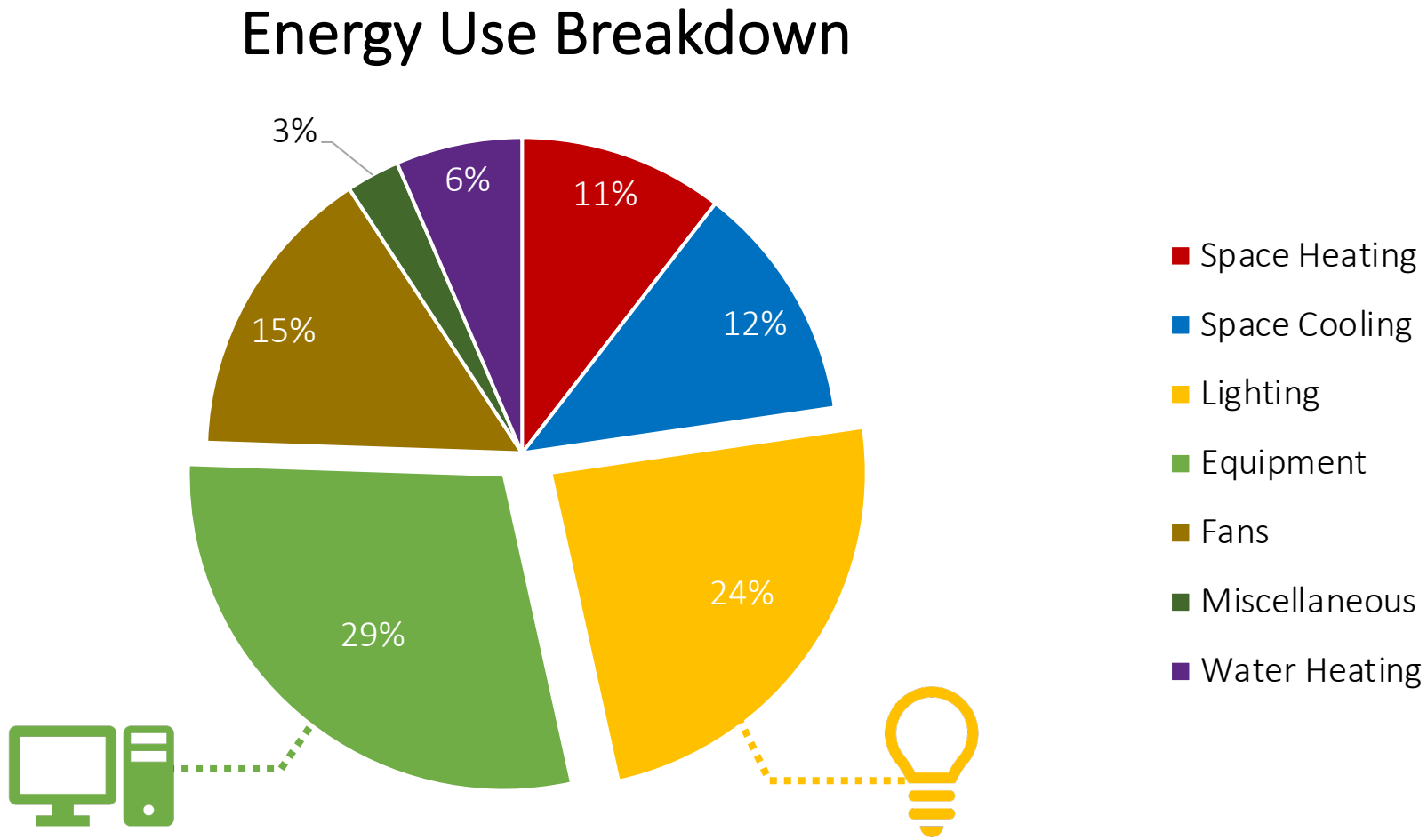
Simulation Results



Plug Load Densities:
0.28 W/ft^2 (3.0 W/m^2)

Lighting Power Densities:
0.5 W/ft^2 (5.4 W/m^2)

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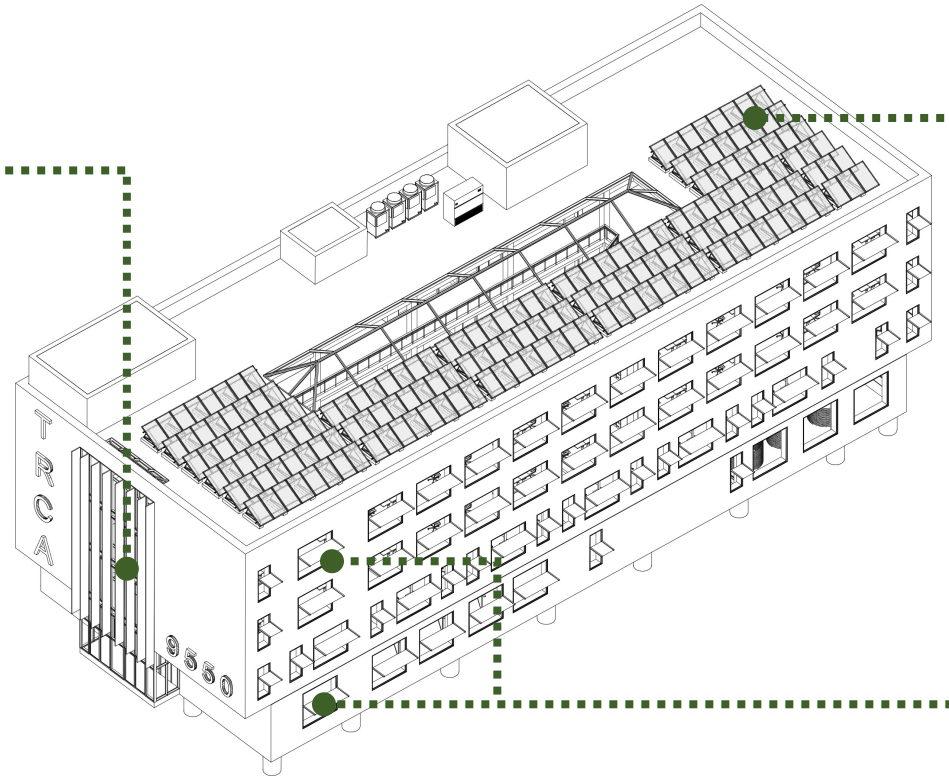
Renewable Energy Generation

Carport from southwest parking



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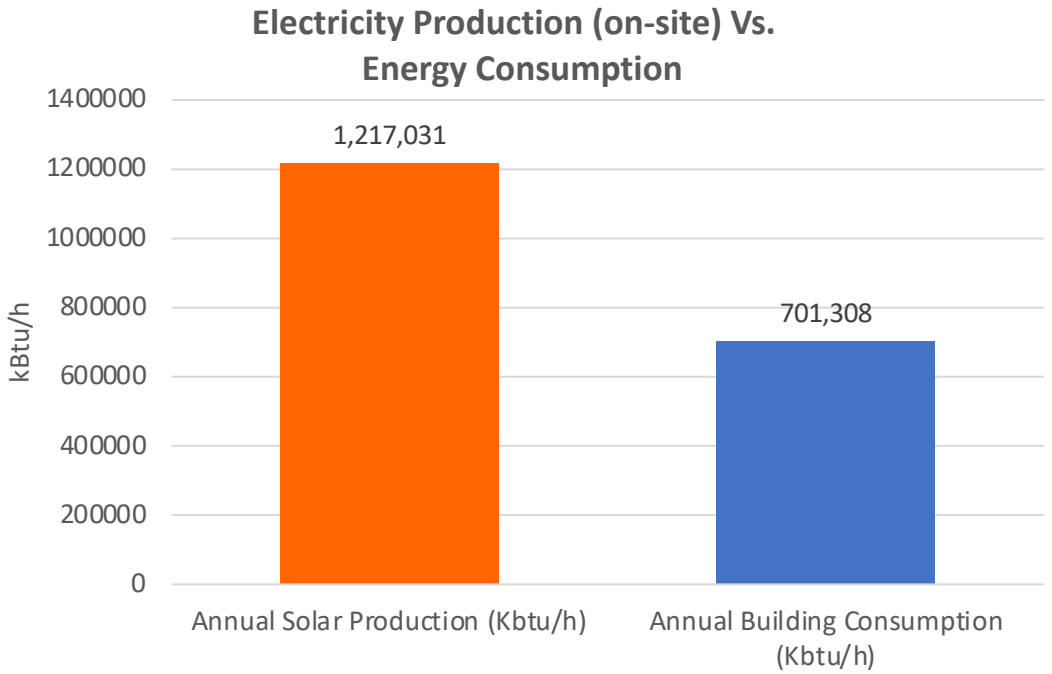
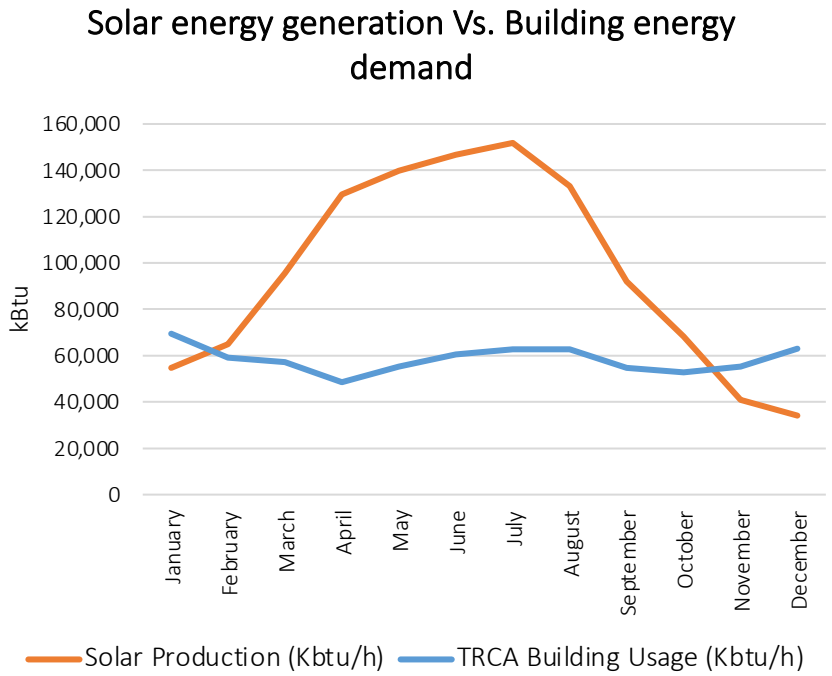
ANNUAL PRODUCTION





	Production (MWh)	Production (kBtu/hr)	Tilt	Number of PV Panels	Power (kw)	Power (Kbtu)	Source
Roof Top	85	290,020	38°	124	70	239	Canadian Solar
Carport	252	858,800	0°	400	228	778	Canadian Solar
Shading	19	65,481	0°	60	70	239	Solaronix
Total	356	1,217,031					
EUI after Renewables	**- 45.6 kwh/m²**	**- 14.5 kBtu/hr ft²**	**Net positive**				

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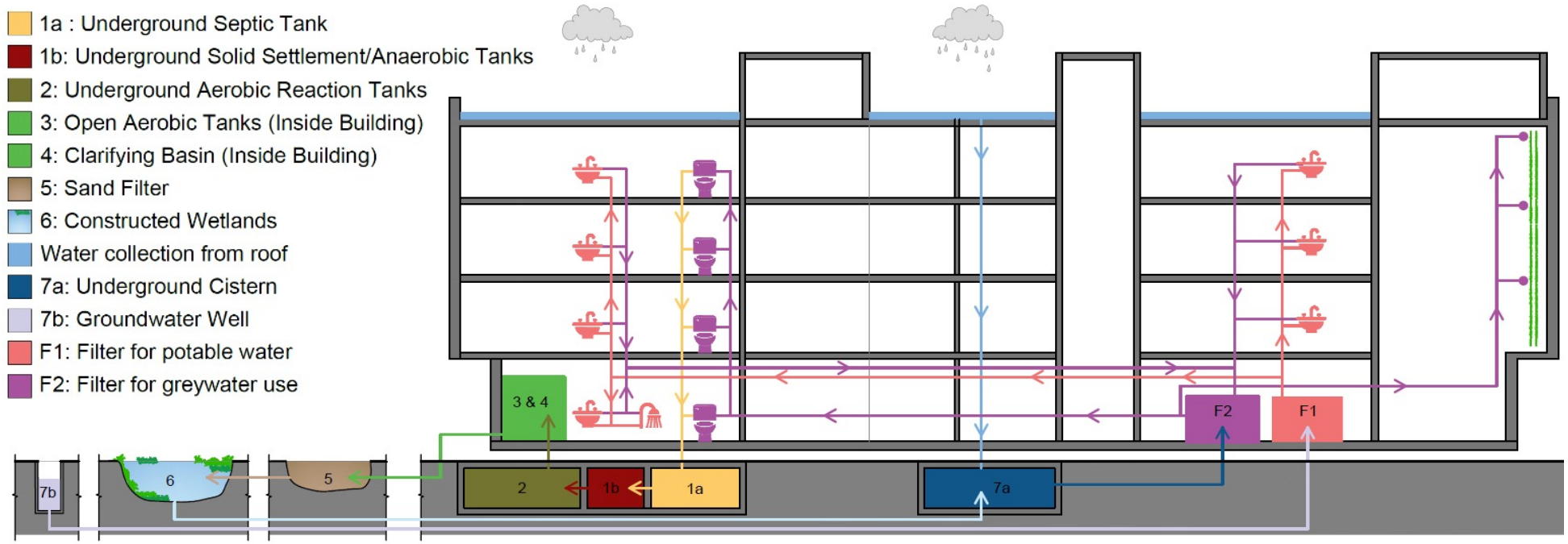
SELF SUSTAINING BUILDING- NET-0 ENERGY & WATER

Total Greywater Demand (Washroom + Irrigation)	Total potable water demand (Kitchen+ Dishwasher+ showers+ Washroom Sinks)	Rooftop Collection	Underground Wells	Total annual water demand
392 m^3/yr	692 m^3/yr	643m^3/yr		1,084 m^3/yr
103,555 gal./yr	182,807 gal./yr	169,863 gal./yr		286,363 gal./yr
Filtered using Filter 2	Filtered using Filter 1	Filtered using Filter 2	Filtered using Filter 1	

Table: Potable and non-potable water demand of the building



Water Generating systems

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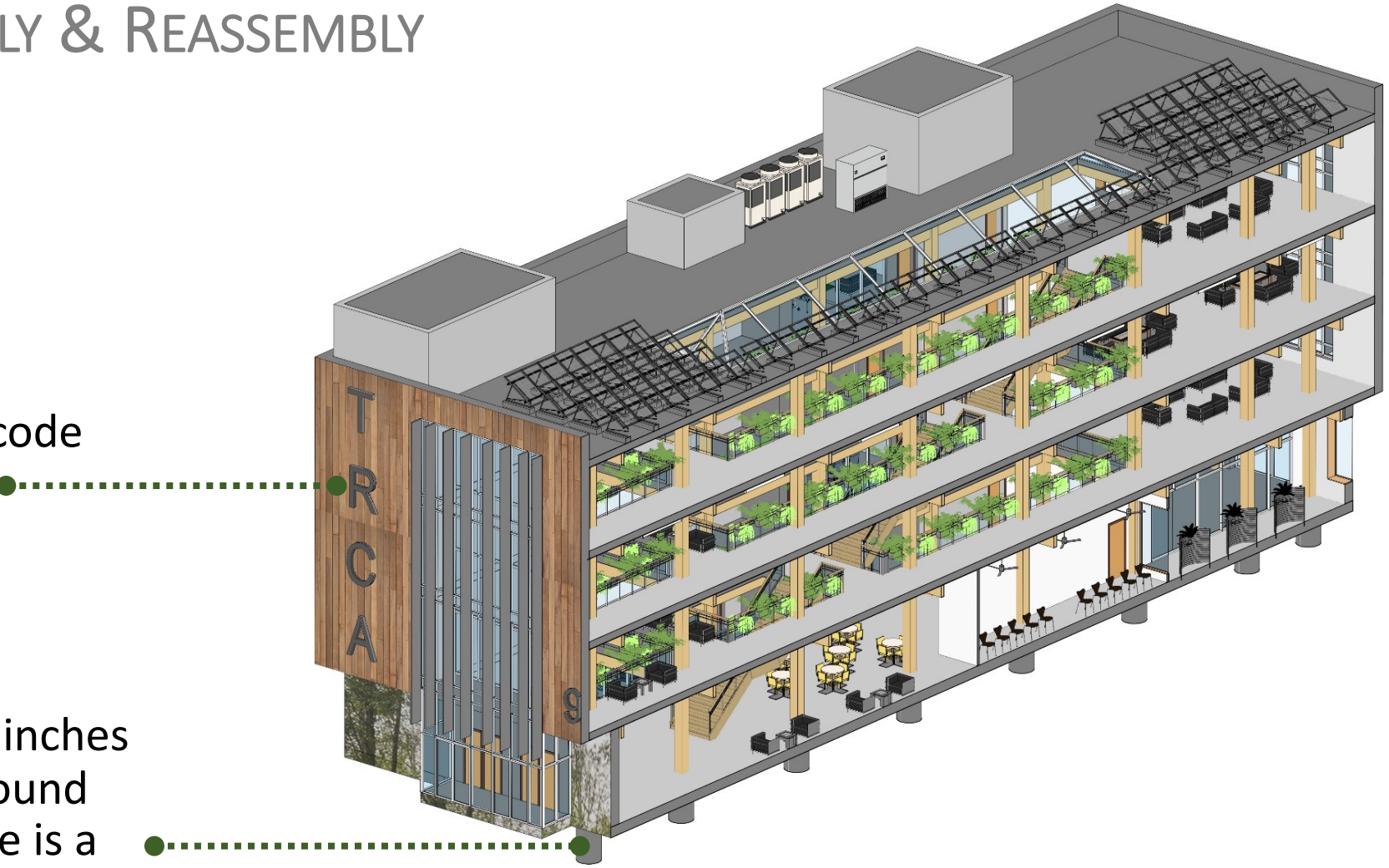
Elevated Building Structure Disassembly & Reassembly

Unique QR code "tag" for all materials

Elevated 15 inches from the ground since the site is a possible future flood plain



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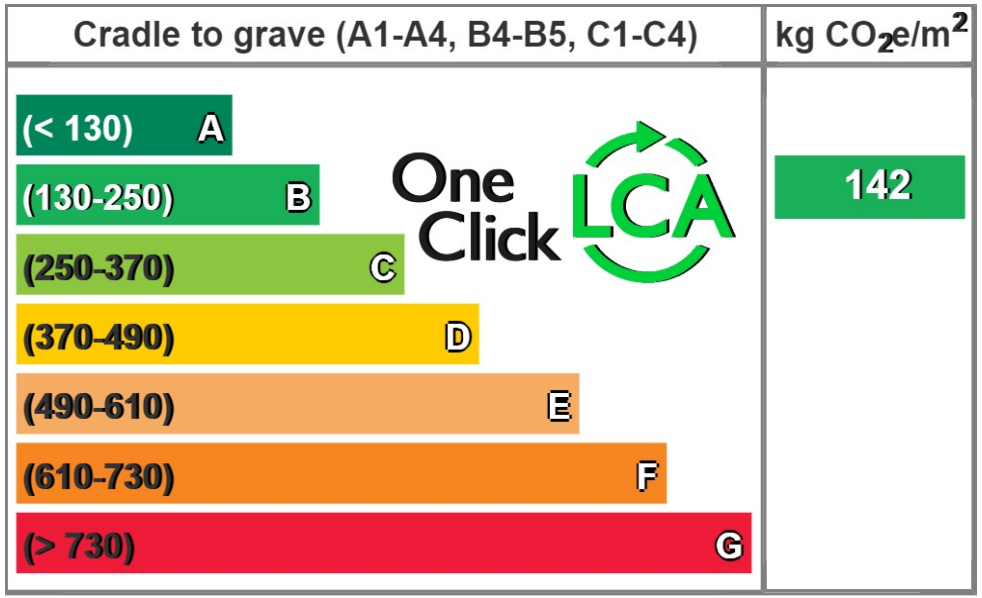
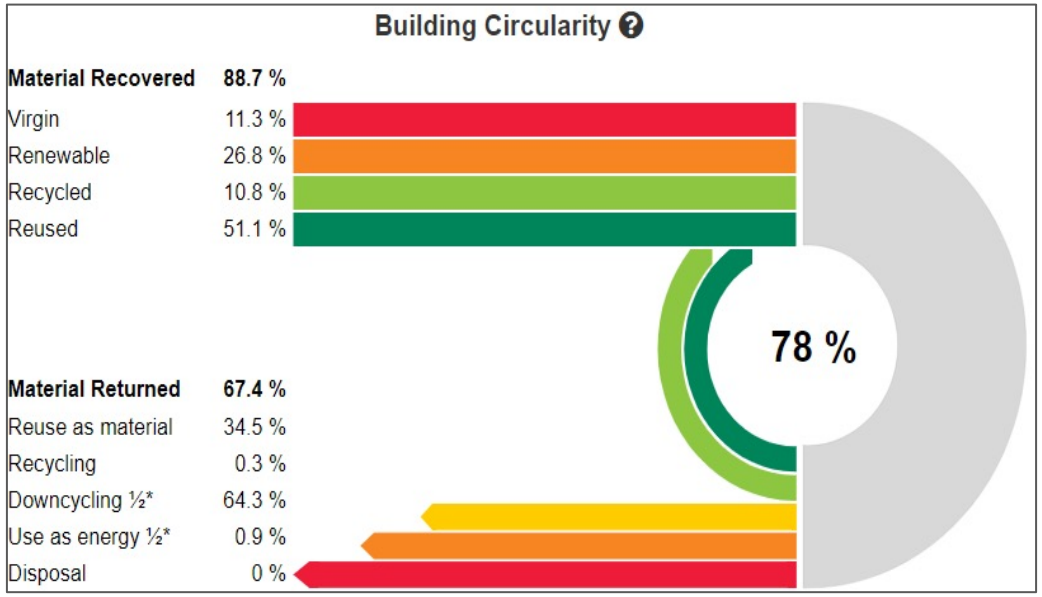
GLOBAL WARMING: CRADLE TO GRAVE





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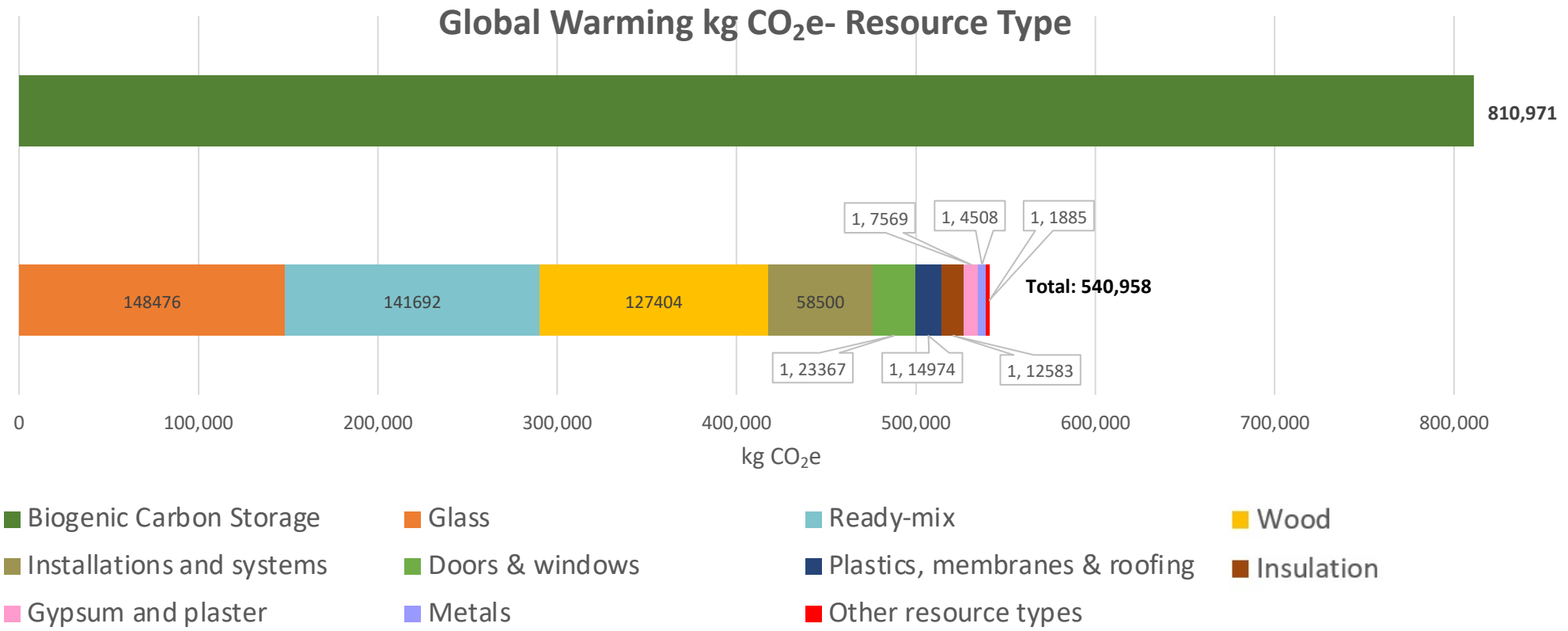
GLOBAL WARMING: RESOURCE TYPE



- Biogenic carbon storage value (Mass Timber) = 810,971 kg CO_2e (sequestering carbon)
- NET-Zero Energy Building = Zero Operational Carbon = Lifetime NET-Zero Carbon Building

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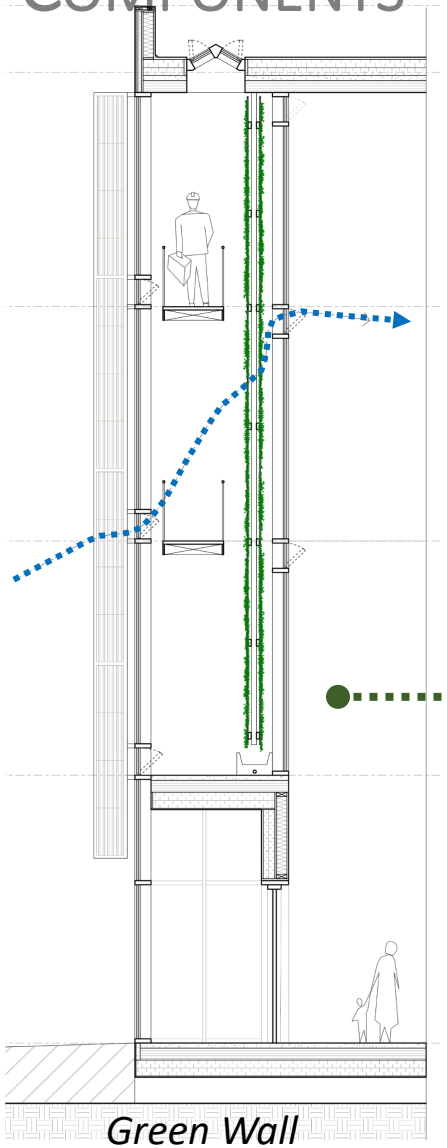
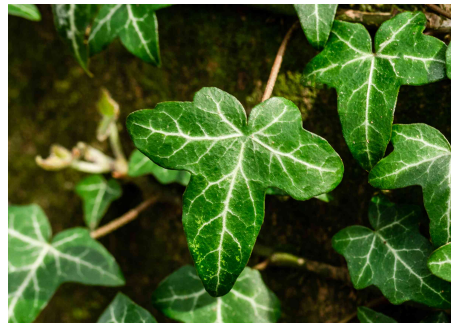
Air Purification- Natural Ventilation & Biophilic Components



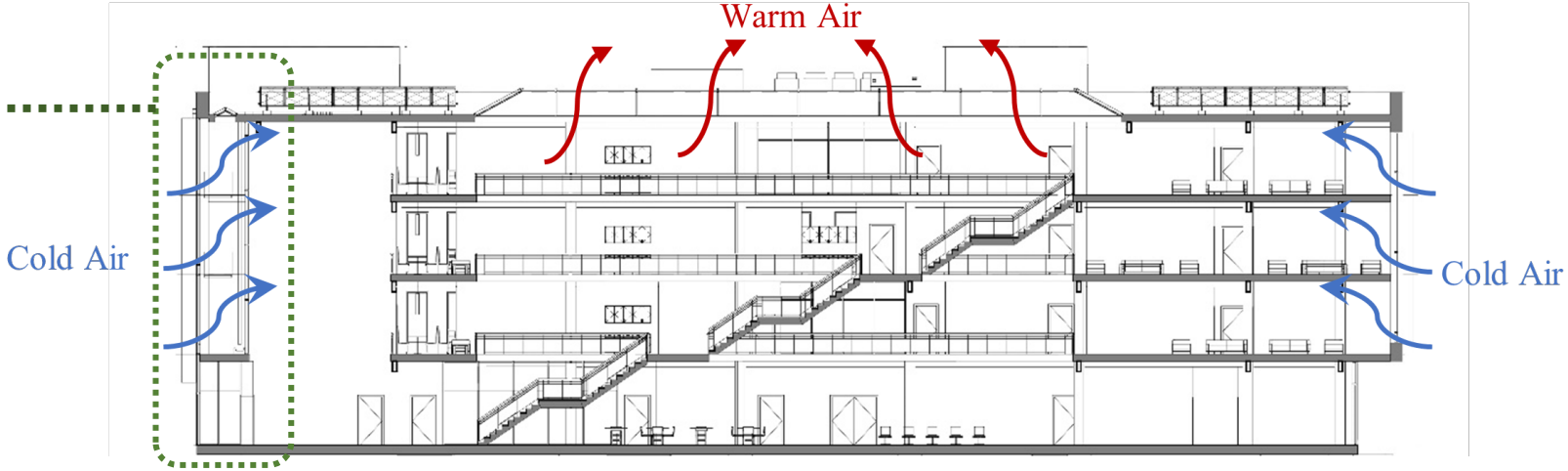
Green Wall

Peace Lily

Boston Fern



English Ivy



Natural Ventilation + Stack Effect

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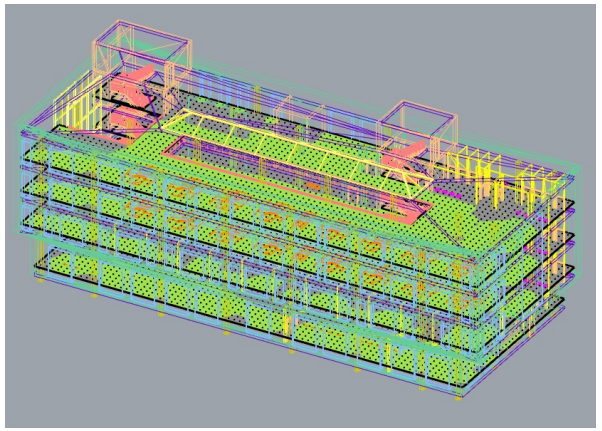
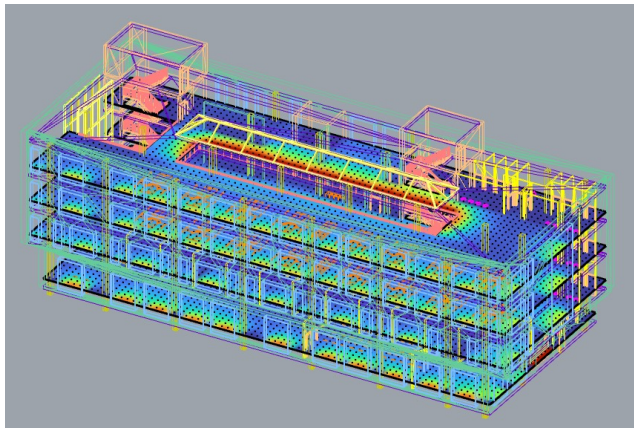
DAYLIGHTING

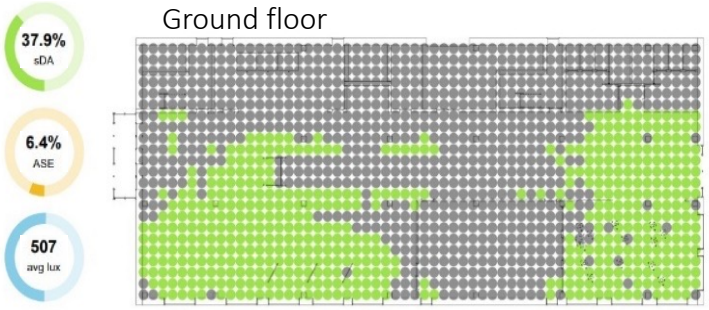
Spatial Daylight Autonomy (sDA)



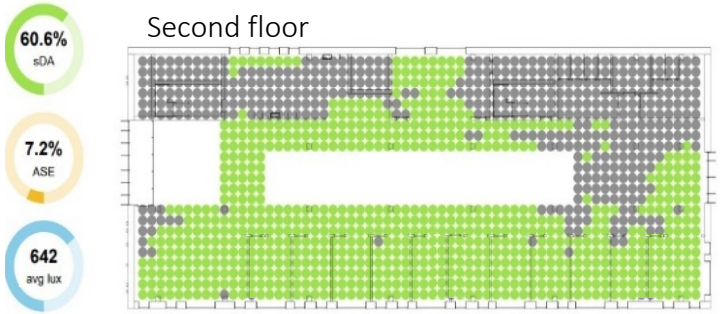
Illuminance (lux)



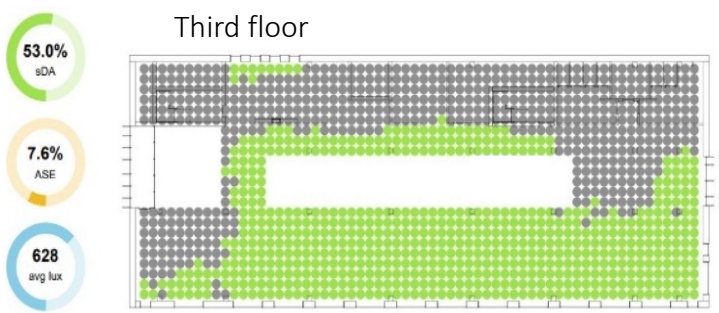
Ground floor



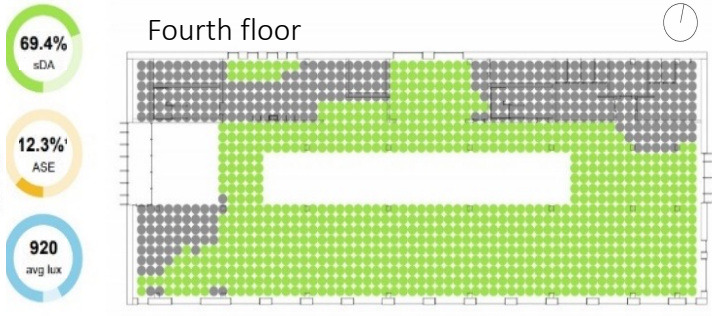
Second floor

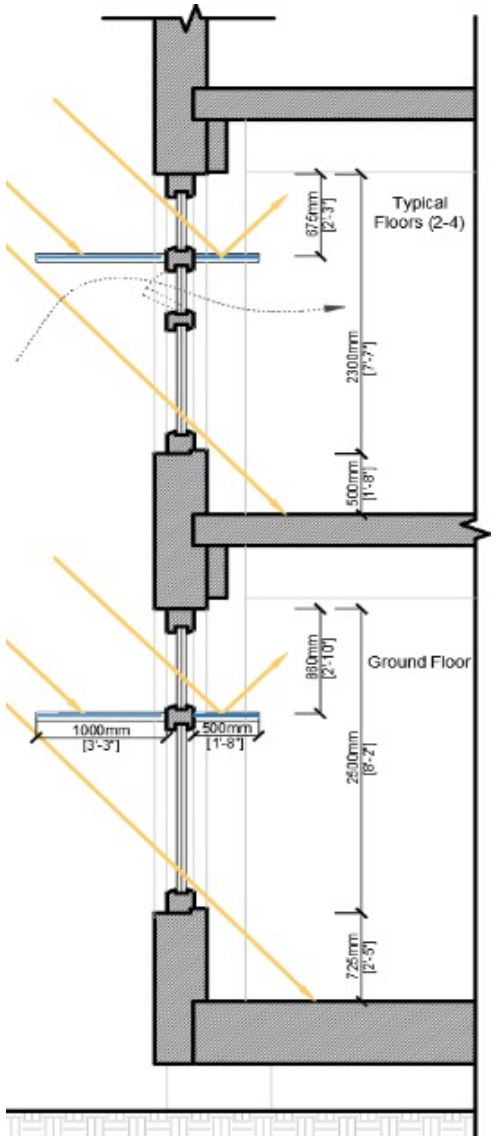


Third floor



Fourth floor





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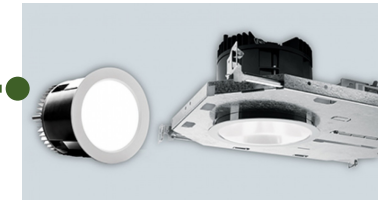
ARTIFICIAL CIRCADIAN LIGHTING

5000K LED A19
Light Bulbs

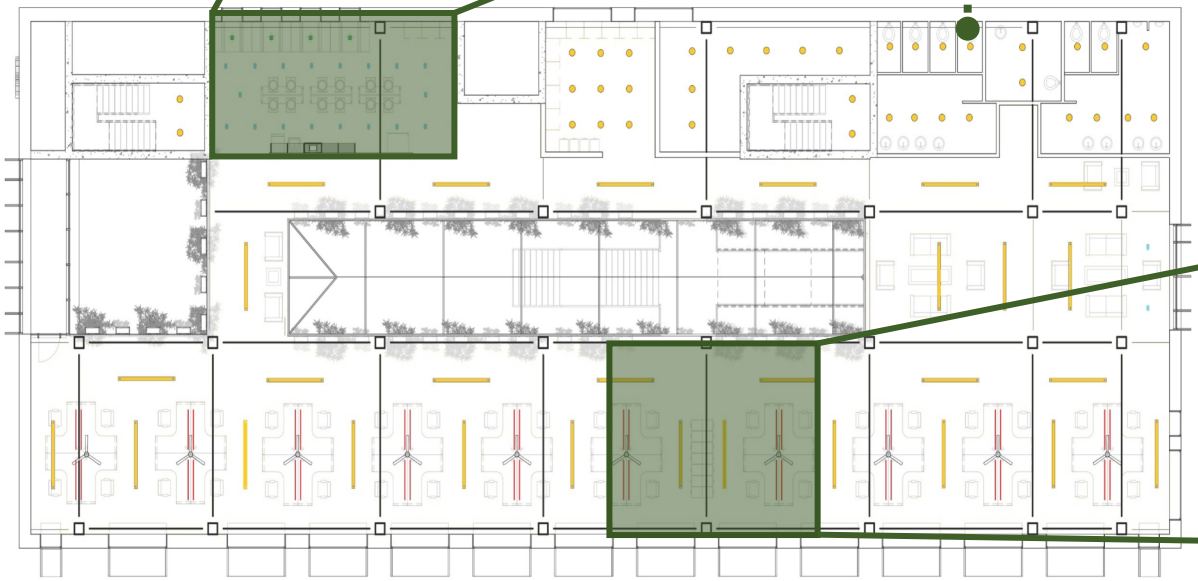
Slim Circadian LED
Downlight



Circadian Zirc™ LEDs CZ4DR

FROVI Task Light

Circadian Zirc™ LEDs CZMX4UD



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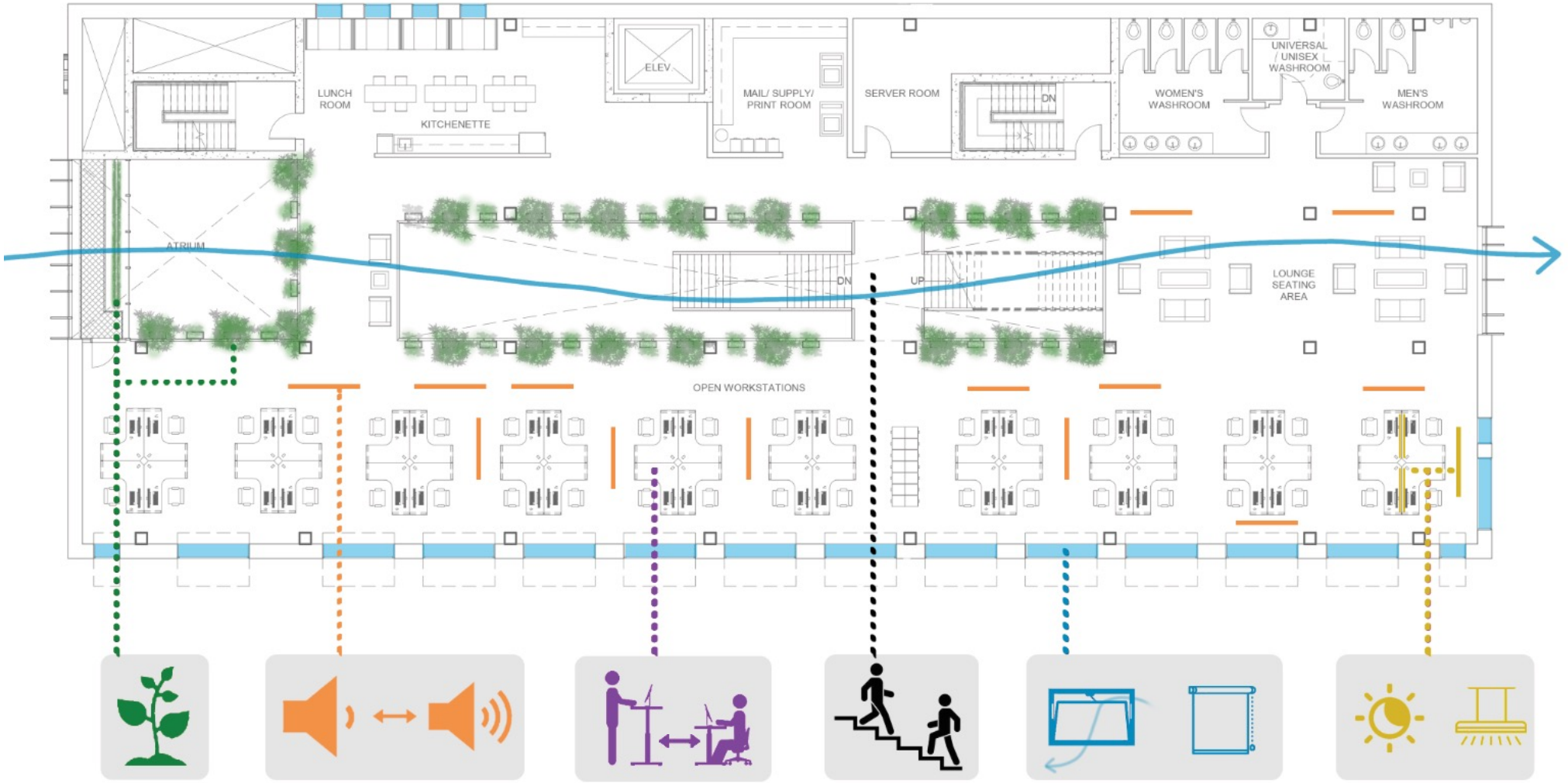
Occupant Experience



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Integrated Design Process

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SOUND MATERIALS MIND COMMUNITY INNOVATION

ENERGY EQUITY HEALTH BEAUTY MATERIALS SITE WATER
LIVING BUILDING CHALLENGE℠

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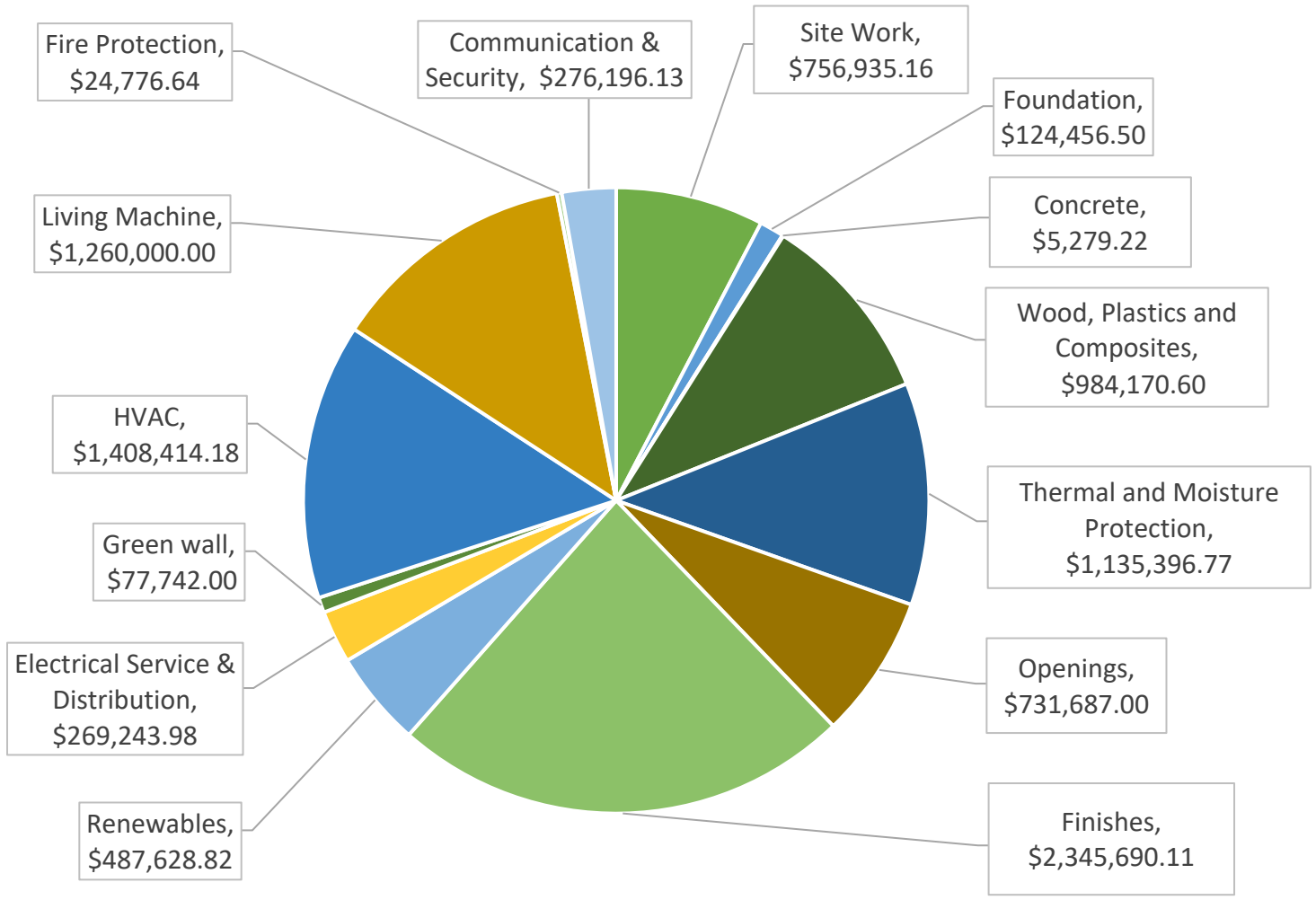
COST ESTIMATION



- The cost is **10,436,930 USD** (251 USD/sq.ft- 316 CAD/sq.ft)
- Including energy efficient strategies, renewables and biophilic components.

Introduction
Architecture
Engineering
Energy Performance
Durability and Resilience
Embodied Environmental Impact
Comfort and Environmental Quality
Occupant Experience
Integrated Performance
Market Analysis
Conclusion

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Consultant

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Program Advisor Council (DAS, Ryerson)
Principal Architect, Sustainable TO

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HVAC lead

ELEVATE

THANK YOU!

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RYERSON UNIVERSITY

Office Building Division | TRCA Satellite Visitors Centre and Office